SWITCHED OUTLET MODULE AND METHOD THEREFOR

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BACKGROUND OF THE INVENTION

1. Field of the Invention:

This invention relates to electrical power control, and more specifically, to the control of electrical devices, including lamps, by both standard wall switches and additional controls without the position of any wall switch or control preventing the others from operating.

2. Description of the Prior Art:

To promote safety, the National Electrical Code Section 210-70(a) requires every room in a house or office to have lighting controlled by a wall switch. In most rooms, the wall switch can control one or more receptacle outlets to power floor, table, desk or other plug-in lamps. If a switch on a lamp is turned off, the wall switch can no longer turn on the lamp. This thwarts the intended safety of lighting a room before entering it. A table lamp on a night stand exemplifies the problem. Before going to sleep, the lamp is switched off. The next morning there is no impetus to turn the lamp switch back on. The next evening the wall switch can no longer turn on the lamp. Thus, one needs to walk in

the dark towards the lamp and fumbling in the dark to locate the lamp switch to light the room.

Lamp switches are often found in inconvenient locations, such as under a lamp shade next to the base of a burning light bulb, on a lamp cord, or behind the lamp. Such switch locations require bending down, reaching underneath a lamp shade near a hot, bright light bulb, or reaching around behind a lamp or table to reach the lamp switch. Switches in these common locations are often difficult to locate and to operate. Even lamp switches on the base of a lamp are not always easy to reach and operate.

It would be desirable to provide one or more remote controls that allow the following: can be placed in easily accessible locations to replace the function of lamp switches, which cooperate with wall switches, provide additional functional features, and are easy to find and operate. Existing lamp switches can be left in the ON position, and can optionally have the switch knobs or handles removed or fixed in the ON position. The original lamp switches will most likely be ignored because the remote controls will be located in preferable locations, making them easier to use than the lamp switches. For example, a touch switch sitting on a night stand is easier to reach and operate.

To simplify installation and thereby reduce cost, it is desirable that the device plug into a standard wall outlet and the lamps or other electrical devices and an additional control or controls connect to the device. This avoids modifications to

building wiring and the need for an electrician or any special tools to install it.

Therefore a need existed to provide an improved system and method for overcoming the above problem. The improved system and method will provide one or more remote controls that can be placed in easily accessible locations to replace the function of lamp switches, cooperate with existing wall switches, provide additional features, and are easy to find and operate.

SUMMARY OF THE INVENTION

In accordance with one embodiment of the present invention, it is an object of the present invention to provide a switched-outlet module and one or more remote controls.

It is another object of the present invention to provide a switched-outlet module and a remote control or controls that are highly portable and easily placed in accessible locations.

It is another object of the present invention to provide a switched-outlet module and one or more remote controls that are easy to install, remove, and reinstall.

It is yet another object of the present invention to provide a switched-outlet module and one or more remote controls that are easy to install and reinstall that do not require the user to have or use any special tools or technical training to install, remove, or reinstall.

It is still another object of the present invention to provide a switched-outlet module and one or more remote controls that are easy to install, remove, and reinstall that do not require the user to make any modifications to existing wiring to install, remove, or reinstall.

BRIEF DESCRIPTION OF THE PREFERRED EMBODIMENTS

In accordance with one embodiment of the present invention a switched outlet module which controls power to one or more electrically powered devices which are connected to the module and which are under the control of a wall switch is disclosed. The module has outlet jacks wherein at least one outlet jack is a switched outlet jack and at least one outlet jack is an unswitched outlet jack. A switching device is coupled to the outlet jacks to control whether the switched outlet receptacle is on the top or bottom of the wall receptacle. Connectors are coupled to the switched outlet jack for connecting remote controlled devices that control device coupled to the switched outlet jack. Control circuitry is coupled to the switching device to monitor and limit a current through the switched outlet jack, to monitor and limit a current through the switching device, and to interpret signals from remote controlled devices coupled to the connectors. Contacts are coupled to the control circuitry to couple the module to a switched electrical receptacle.

The foregoing and other objects, features, and advantages of the invention will be apparent from the following, more particular, description of the preferred embodiments of the invention, as illustrated in the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, as well as a preferred mode of use, and advantages thereof, will best be understood by reference to the following detailed description of illustrated embodiments when read in conjunction with the accompanying drawings, wherein like reference numerals and symbols represent like elements.

FIG. 1 shows simplified electrical block diagrams of various methods of wiring switched outlets for 1, 2, 3 or more wall switches.

FIG. 2 shows different views of the switched outlet module of the present invention.

FIG. 3 shows a block diagram of the switched outlet module depicted in FIG. 2.

FIG. 4 shows an electrical schematic of the switched outlet module depicted in FIG. 2.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, three electrical schematics depict a variety of ways two-circuit duplex receptacles can be wired to provide a switched outlet in a building. Outlet **10** shows a single-pole wall switch which controls power to the bottom outlet of a duplex receptacle. The bottom outlet is switched but it could be reversed as in **11** where the top outlet is switched. There is no standard to determine which outlet of a duplex receptacle is switched and which is not. The outlet **11** also has two 3-way switches coupled thereto to provide two wall switches, each of which can control the switched outlet **11**. The circuit for the outlet **11** is used when a room has two doorways or entrances. Outlet **12** has wiring to provide three or more wall switches that can each control power to the switched outlet **12**. Additional 4-way switches can be connected in series to provide four or more wall switches.

Outlet **10** also shows multiple switched outlets controlled by one wall switch. Outlet **11** also shows an ungrounded, polarized receptacle which is usually found in older buildings which do not have ground wiring. Outlet **12** shows a receptacle mounted upside-down compared to the receptacles in **10** and **11**. There is no standard to determine which way a receptacle is mounted in an outlet box, so both orientations are used. Hereinafter the orientation of outlet **10** will be used to indicate the top and

bottom outlets of a two-circuit switched receptacle for the purposes of this patent.

The neutral wire is always connected to the wider slot on a receptacle and the hot wire to the narrower slot, as required by the National Electrical Code. Only the hot wire can be switched, the neutral wire must remain connected, not switched. On a two-circuit receptacle, the two neutral slots may or may not be connected to the same neutral wire. The unswitched outlet may be connected to a separate circuit from the switched outlet, so the switched-outlet module must not return current from the hot wire on one outlet to the neutral wire of the other outlet; or a ground-fault circuit interrupter (GFCI) may be triggered on either circuit as a result of the current imbalance it would create.

Referring to FIGS. 2, 3 and 4, wherein like numerals and symbols represent like elements, a switched outlet module **90** is shown. The switched outlet module **90** has male blades **100** and **101** that plug into a switched wall receptacle. Blade **100** is the top plug and blade **101** is the bottom plug. Elements **128** and **129** are the two switched jacks on the module that two controlled lamps or other electrical devices plug into. Jack **128** is the first switched jack and jack **129** is the second switched jack. Elements **130** and **131** are unswitched jacks. The unswitched jacks **130** and **131** will always supply AC power available to fulfill the "6-foot rule" which states that for every 6 feet of wall space there shall be at least

one unswitched outlet.

Connectors **132** and **133** are inputs for wired remote controls which primarily control the first switched jack **128**, and the second switched jack **129** respectively. Connectors **132** and **133** may be connected directly to different types of control mechanisms. For example, connectors **132** and **133** may be connected directly to mechanical or touch switches, interfaces to computer networks, standard busses, wireless receivers, and the like. It should be noted that the listing of the above should not be seen as to limit the scope of the present invention.

Slide switch **106** is a position switch which selects whether the unswitched outlet is on the top or bottom outlet of the wall receptacle. In the embodiment depicted in FIG. 3 the position switch **106** is a 3-pole, double-throw switch (3PDT). The first pole **107** of position switch **106**, is set to connect to the unswitched hot wire **102** from the receptacle, which connects to the hot blade of plug **100** in the schematic. The second pole **108** of position switch **106** connects to the switched hot wire **104** through the bottom plug **101**. This connects the switched hot wire from the receptacle through current limiting resistor **125** to an input pin on the microprocessor **110**. This allows the microprocessor **110** to sense the state of the wall switch. The third pole **109** of position switch **106** selects the neutral wire **105** from the unswitched outlet. The neutral wire **105** from the bottom (switched) outlet cannot be

used as a return because it could be connected to a separate circuit in the building which would contradict code and pose a safety hazard.

Resistors **126** and **127** provide a leakage shunt to ensure that the hot wires **102** and **104** respectively, whichever is connected to the switched outlet and whenever the wall switch is off or open, will provide a reliable signal through resistor **125** to the microprocessor **110**.

The unswitched hot wire **107** and unswitched neutral wire **109** provide AC power to a power supply **111** which converts the power to a DC voltage appropriate to power the microprocessor **110**. This may be any type of AC to DC power supply circuit including a charge pump.

Switching devices **112** and **113**, which may be relays, contactors, solid state relays, or solid state devices include thyristors (triacs, silicon controlled rectifiers (SCRs), alternistors), transistors including junction field-effect transistors (JFETs), metal-oxide silicon field-effect transistors (MOSFETs) and insulated-gate bipolar transistors (IGBTs), switch the power to switched jacks **128** and **129** respectively. It should be noted that the listing of the different types of switching devices **112** and **113** are giving as examples and should not be seen as to limit the scope of the present invention.

Current limiting resistors **114** and **115** serve two functions. First, the voltage across each increases with the load current connected to switched jacks **128** and **129** respectively. These two voltages are current limited by resistors **118** and **119**, respectively, and connected to two input pins on the microprocessor **110**. This allows the microprocessor **110** to sense whenever too much current is being drawn through either switched jack **128** or **129**, which indicates an overload condition. The microprocessor **110** can then take appropriate action to protect switching devices **112** and **113** from overheating and damage.

The second purpose of resistors **114** and **115** is to limit current through switching devices **112** and **113**, respectively, during a light bulb burnout. Incandescent light bulb failure, when the tungsten filament breaks, can result in a tungsten arc which requires about 15 volts and 1 amp to maintain. The event is called flashover and is analogous to TIG (tungsten inert gas) welding. It can draw all of the current available from the power circuit. The arc is usually extinguished when the AC voltage crosses zero, cutting off the necessary current to fuel the arc. In the mean time of up to one half of a 60 Hz cycle, or about 8.33 milliseconds, a thyristor can be subjected to extremely high current. Resistors **114** and **115** are selected to limit this extreme current to a level that the switching devices **112** and **113** can survive for a half cycle without damage. Resistors **114** and **115**

must also be able to survive the extreme current for the duration of the flashover. Without this protection the switched outlet module **90** could burnout as the result of a simple light bulb failure.

Resistors **116** and **117** limit current from the two microprocessor output pins that drive the gates of switching devices **112** and **113**, respectively. The microprocessor **110** drives a thyristor gate low to turn each thyristor on. This, in turn, enables power to each of the switched jacks, **128** and **129**.

Resistor pairs **120** and **122**, **121** and **123** are voltage dividers to reduce the voltage from the remote controls **132** and **133**, to two input pins on the microprocessor **110**. The two microprocessor input pins sense when the remote controls are active to control the state of power jacks **128** and **129**. It is completely up to the microprocessor **110** programming to interpret the remote control signals and act upon them. If the remote controls are touch sensors, the microprocessor **110** samples the remote control inputs near the positive peak of the unswitched hot wire, **107**. A person contacting a touch sensor will apply a voltage near ground or neutral to the remote control input **132** or **133**. This will cause a microprocessor input pin to go low, signaling the touch. The resistance of resistors **120** and **121** must be very high to limit the amount of current conducted to a person contacting a touch sensor.

Resistor **124** allows the microprocessor input pin connected through resistor **118** to detect AC zero-voltage crossing even if no load is connected to switched jack **128.**

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.